

## **EV/PI CONFERENCE**

## **EVMS BASICS**

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# **Earned Value Management Defined**

Establishment and application of an integrated management system that coordinates work, schedules, and cost objectives and employs earned value methods for program planning and control



## **Purpose of EVM**

Provide Government and supplier Program Managers with accurate data to monitor the execution of their program to:

- Provide adequate basis for reasonable decision making
- Encourage suppliers to implement effective management control systems
- Supplier's systems provide data which:
  - Indicate work progress
  - Relate cost, schedule, and technical progress
  - Are valid, timely, and auditable
  - Practical level of summarization
- Minimize changes to supplier's internal systems
- Single system for internal management and Government reporting



## **Earned Value Management Systems**

#### **EVMS Processes**

- Organizing
- \*Scheduling
- Work/Budget Authorization
- \*Accounting
- Indirect Management
- Managerial Analysis
- Change Incorporation
- ❖Material Management
- Subcontract Management



## Basic Requirements of Earned Value Management

- ☐ Plan the entire contractual effort
- Determine accomplishment at level where work is done
- Measure accomplishment objectively
- Summarize data for higher levels
- Analyze variances and impacts
- Develop estimate of final cost



# Supplier EVM Requirements

- Define contractual effort and assign responsibilities for the work
- Plan, schedule, budget, and authorize the work
- Accumulate cost of work and material
- Compare planned and actual costs, analyze variances, and develop estimate of final cost
- Incorporate internal and external changes



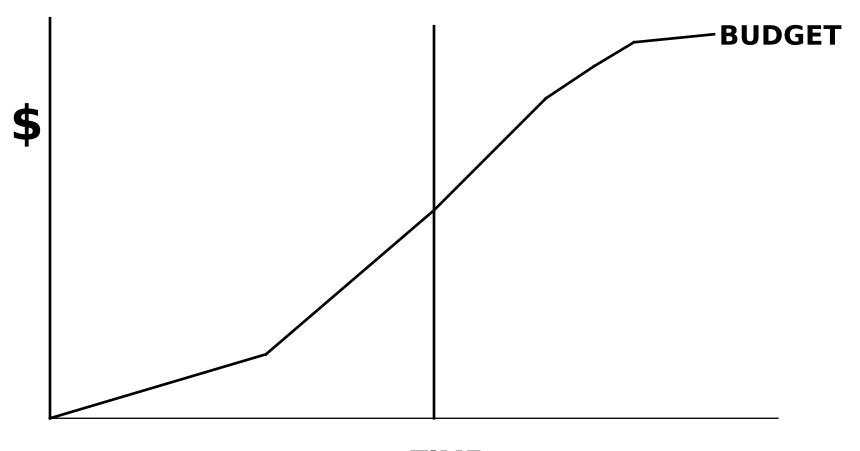
# Performance Measurement Data Elements

# Budgeted Cost for Work Scheduled (BCWS)

The sum of the budgets for all work packages, planning packages, etc., planned to be accomplished (including in-process work packages), plus the amount of level of effort and apportioned effort planned to be accomplished within a given time period.



## **BCWS Planned Accomplishment**





## Performance Measurement Data Elements

# Budgeted Cost for Work Performed (BCWP)

- The sum of the budgets for completed work packages and completed portions of open work packages.
- BCWP is the value of the work accomplished
- I BCMD is also known as EADNED VALUE



# **Earned Value**

- An objective measure of work accomplished
- Based on the budgeted value



## **The Earned Value Process**

Identify short tasks

Schedule each task

Assign a value to each task

Measure progress of the tasks



# Three Classifications of Work Measurement

Discrete effort

Apportioned effort

Level of effort (LOE)



## **Work Categories**

- Discrete effort
  - Specific end product or result
- □ Apportioned effort
  - Factored effort directly related to discrete tasks (e.g., quality control, inspection)
    - Dependent on other work
- □ Level of effort
  - No final product or result (e.g., program management)
    - Measure performance with the passage of time



## **Typical Milestones**

- System specification approved
- Preliminary design released
- Prototype material list issued
- Brass board tested
- Printed circuit card design released



## **Level of Effort**

- General or supportive activities
- Have no definite or deliverable product
- Budget is scheduled over the period of performance
- BCWP earned based on passage of time
- □ BCWP = BCWS



# The Control Account A Key Management Control Point

- Specific functional responsibility
- Specific WBS responsibility
- Work planning and assignment (BCWS)
- Earned Value (BCWP)
- Cost collection (ACWP)
- Variance analysis (SV= BCWP-BCWS, CV= BCWP-ACWP)
- Corrective action
- Basis of OBS/WBS summarization



## **Work Package**

- Represents units or work at levels where work is performed.
- It is clearly distinguished from all other work packages.
- It is assignable to a single organizational element and control account.
- It has scheduled start and completion dates and, as applicable, interim milestones all of which are representative of physical accomplishment.



## **Work Package**

(continued)

- It has a budget or assigned value expressed in terms of dollars, man-hours or other measurable units.
- Its duration is limited to a relatively short span of time or it is subdivided by discrete milestones to facilitate the objective measurement of work performed.
- It is integrated with detailed engineering, manufacturing or other schedules.



# Actual Cost for Work Performed (ACWP)

(ACWP)
The costs actually incurred and recorded in accomplishing the work performed (BCWP) within a given time period.

- Labor
- Material (sub-supplier/vendor)
- Other (computer costs, etc.)
- Indirect costs



## Performance Measurement Data Elements

**Budget at Completion (BAC)** 

The budgetary goal (excluding MR) for doing all the authorized work. This includes the value of a work package, planning package, control account or WBS element.



## Performance Measurement Data Elements

## **Estimate at Completion (EAC)**

- ☐ Actual direct costs, plus indirect costs allocable to the contract
- ☐ Plus the estimate of costs (direct and indirect) for authorized work remaining
- ☐ Often quite subjective
- ☐ Usually very optimistic



# Performance Measurement Data Elements

## **Management Reserve (MR)**

An amount of the total allocated budget withheld

for management control purposes rather than designated for the accomplishment of a specific task or set of tasks.



# Performance Measurement Data Elements

## **Undistributed Budget (UB)**

Budget applicable to contract effort which has not yet been identified to CWBS elements at or below the lowest level of reporting to the Government.



## **Schedule Variance**

- □ Earned value (BCWP) minus BCWS
- Dollar value of work ahead/behind schedule
- Only an indicator



## **Cost Variance**

- Earned value (BCWP) minus actual cost (ACWP).
- Budgeted value of what you accomplished minus what it actually cost.



# Performance Measurement Data Elements

## **Variance at Completion (VAC)**

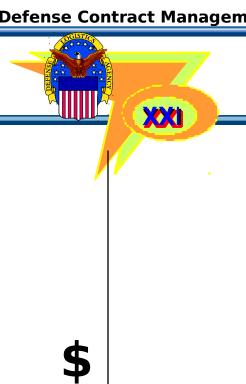
The forecasted difference between the authorized

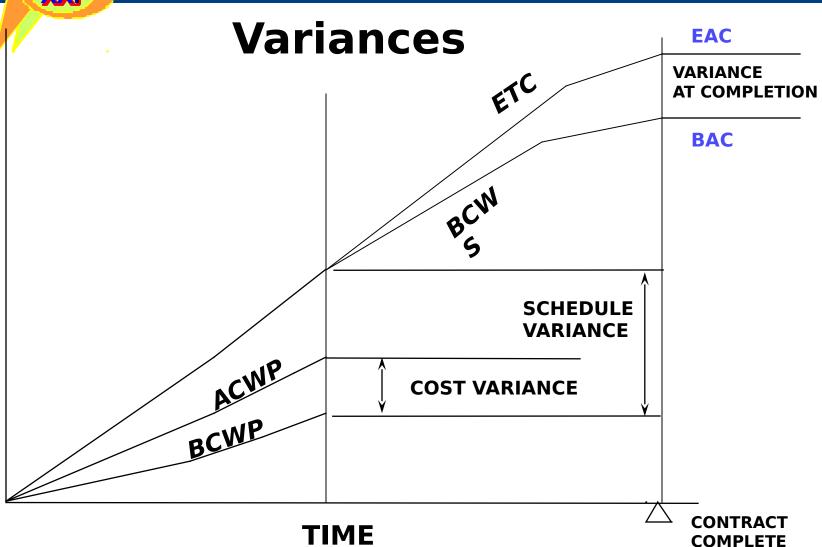
budget (BAC) and the estimated cost at completion

(EAC) projected for accomplishing the agreed to

work (BAC - EAC).

 The VAC is sometimes referred to as underrun or overrun.







## **Cost Elements**

Total costs are comprised of four cost elements

- Labor Rate and usage variances
- Material Price and usage variances
- Overhead Pools/fixed, semi-variable, variable, variable
- Subcontract Subcontract terms and conditions

Each one of these elements must be examined to understand what is driving SV and CV at the top levels



# **Cost Variance and Cost Variance Percentage**

CV = work accomplished - actual cost of work accomplished

CV = BCWP - ACWP CV% = CV / BCWP

- □ A negative variance means more money was spent for the work accomplished than was planned.
- □ Cost variance percentage is the percentage of cost incurred above the budgeted value for the completed work (BCWP).



# Schedule Variance and Schedule Variance Percentage

SV = work accomplished - work scheduled

- Indicates whether work is being accomplished as planned.
- It is not a replacement for critical path analysis, etc.
- □ A measure of "In Process" work only.

Zero before work is started (or planned to start)
Zero after work is finished (and planned to finish)

□ SV% is the percentage of the work scheduled that has not been accomplished.



## **Cost Performance Index (CPI)**

CPI Planned cost of work accomplished
Actual cost of work accomplished

$$CPI = \frac{BCWP}{ACWP}$$

- Indicates the efficiency at which work is being accomplished.
- Indicates the value of every dollar of work accomplished.
- The higher the number, the better the cost efficiency.



## **Schedule Performance Index (SPI)**

$$SPI = \frac{BCWP}{BCWS}$$

- Indicates the efficiency at which scheduled work is being accomplished.
- Indicates the percentage of planned work that has been accomplish
- □ The higher the number, the better the schedule efficiency.



## To Complete Performance Index (TCPI)

$$TCPI = \frac{(BAC - BCWP)}{(EAC - ACWP)}$$

- ☐ Also known as the verification factor.
- □ Indicates efficiency which must be achieved to complete the remaining work with expected remaining money.
- Compare to cum CPI for reasonableness of EAC.



# Performance Measurement Data Elements

#### Level 3 WBS Element Performance

<b>BCWS</b>	<b>BCWP</b>	<u>ACWP</u>		<u>SV</u>	<u>CV</u>	<u>BAC</u>	<u>EAC</u>	<u>V</u>
250K -10	175K	220K	-75	<b>-</b> 45	500	510		

Behind Schedule -75k (BCWP-BCWS)

Over cost -45k (BCWP-ACWP)

Overrun -10k (BAC-EAC)



## **Performance Elements**

BAC EAC Description

50K 50K Forecast on budget

50k 47k Forecast underrun

50k 57k Forecast overrun

At completion variance = BAC - EAC



# Primary Purpose of the CPR

Provide the Program Manager with cost, schedule, and technical status of the program. An impact quantification in dollars and hours, outlining any trends, and providing a basis for detailed analysis of the financial health and technical risk of the contract.



## **Cost Performance Report Formats**

Format 1: Work Breakdown Structure

- WBS Level 1, 2, 3, 4

Format 1A: Integrated Product Teams (IPT)

Format 2: Organizational Categories

Format 3: Baseline

- Changes
- Management reserve
- Undistributed budget

Format 4: Manpower Loading

Format 5: Problem Analysis/Explain Variances Identified

- Nature of problem/reason for variance
- Impact on total program/corrective action
- Amounts attributed to rate changes
- Undistributed budget applications
- Management reserve application
- Baseline changes

#### CLASSIFICATION (When filled in)

COST PERFORMANCE REPORT FORMAT 1 - WORK BREAKDOWN STRUCTURE DOLLARS IN																	
1. CONTRACTOR					2. CO	NTRACT				3. PRO	GRAM				4. REPORT PERIOD		
a. NAME					a. NAME					a. NAME					a. FROM (YYMMDD)		
b. LOCATION (Address and ZIP Code)					b. NUMBER												
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6. ESTIMATED	COST AT COMPLET	ION			ļ.			7. AUTH	ORIZED CO	ONTRACT	OR REPRE	SENTATI	! /E		!		
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	b. WORST CASE				C. SIGNATURE							(YYMMDD)					
c. MOST LIKELY																	
8. PERFORMAN	ICE DATA							•									
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5111561511																	
b. COST OF MO	ONEY	+															
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d. UNDISTRIBUTED BUDGET						•	_	•									
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f. MANAGEMENT RESERVE																	
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CLASSIFICATION (When filled in)	
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			COST PERFORMANCE REPORT FORMAT 3 - BASELINE DOLLARS IN														
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5.	CONTRACT DATA																
a. ORIGINAL b. NEGOTIATED c. CONTRACT CHANGES				CURRENT NEGOTIATED COST (a. + b.)  d. ESTIMATED COST OF AUTHORIZED UNPRICED WORK				ED	e. CONTRACT BUDGET BASE (c. + d.)  f. TOTAL ALLOCATED BUDGET				OCATED	g. DIFFERENCE (e f.)			
h.	CONTRACT START DA	ATE			NITIZATIO	N   j.		COMPLET	TION DAT			COMPLETI	ON DATE			IPLETION DATE	
	(YYMMDD)		DATE	(YYMMDE	))		(YYMME	)D)		(7	YMMDD)			(YYMN	(IDD)		
6.	PERFORMANCE DATA																
		BCWS RCWS FOR				BUDGETED COST FOR WORK SCHED					ULED (BCWS) (Non-Cumulative)						
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	(End of Period)																
7.	MANAGEMENT																
	RESERVE																
8.	TOTAL																



#### **CPR FORMAT**

- Have all canges to the baseline been authorized?
- □ Were there any uses of Management Reserve?
- □ Format 3 BCWS for beginning of period should be the same as current period BCWS on Format 1
- □ End of period cum to date BCWS on Format 3 should be the same as cum BCWS on Format 1
- ☐ Is the Performance Measurement Baseline (PMB) the same as the PMB on Format 1 and 2?
- Is Section 5, Contract Data, complete?
- Bottom-line All data entries should reconcile

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		COST/SCHED	ULE STATUS F	REPORT	DOLLARS IN				
1. CONTRACTOR		2. CONTRACT			3. PROGRAM		4. REPO	4. REPORT PERIOD	
a. NAME		a. NAME			a. NAME		a. FROM	a. FROM (YYMMDD)	
b. LOCATION (Address and ZIP Code	e)	b. NUMBER							
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					RDT&E	PRODUCTIO			
5. AUTHORIZED CONTRACTOR REP				c. SIGNATURE				d. DATE SIGNED (YYMMDD)	
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(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
a. WORK BREAKDOWN									
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d. UNDISTRIBUTED BUDGET		1							
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#### **EAC Defined**

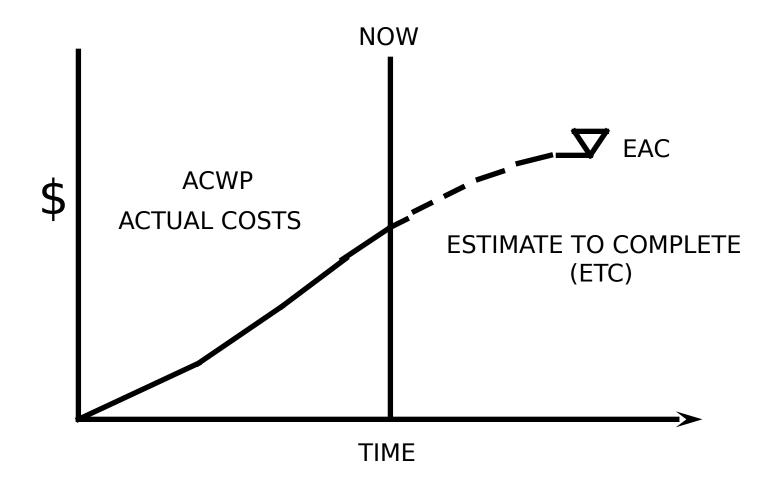
Actual cost of work performed (ACWP) plus the projected cost to complete all remaining work (ETC)

**Formula** 

ACWP + ETC = EAC



#### **Estimate at Completion**





#### Supplier Considerations in Preparing an EAC

- Performance to date
- Remaining work and its anticipated performance
- Schedule completion
- □ Rates (direct & indirect)
- Funding constraints



### **EAC** Frequency and Level

#### **Frequency:**

- ☐ Comprehensive (bottoms-up, grass roots) EAC for the total contract should be accomplished annually at a minimum. The supplier must use all available information, consistently applied procedures, and time phase the ETC.
- ☐ Monthly updates should be made as a routine management function.



## **EAC Formulas/Trends CAO**

Independent Estimate at Completion (IEAC)

**IEAC** = **ACWP** + **PF** (work remaining)

**PF = Performance Factors** 

- ☐ Selection of PF is subjective
- ☐ Cause of existing variance
- ☐ Technical risk
- □ Schedule revisions
- □ Trends
- □ Judgment



#### **METHOD**

#### **EAC** Methods

#### **USEFULNESS**

1.

BAC CPIc M, L

2.

ACWPc + BAC - BCWPc CPIc x SPIc

E, M

3.

ACWPc + BAC - BCWPc (BCWP)

(ACWP) 6 MO

4.

ACWPc + BAC - BCWPc .8CPIc + .2SPIc

E, M

E, M , L

E = Early in contractM = Middle of contract

NOTE: "c" indicates cum data L = Late in contract



#### **EAC Validation Process**

#### **Important Factors:**

- An EAC formula or calculation by itself is only a guide, not the answer
- In order to validate an EAC, one must make every effort to understand the rationale and assumptions.
- Different EACs are acceptable, if you understand why they differ



#### **Benefits of EVMS**

- Confidence in supplier's internal management system
- Objective (rather than subjective) contract information
- □ Cost impact of known problems
- Identification of problems not previously recognized
- Capability to trace problems to their source
- □ Quantitative measure of schedule deviation in dollars
- Measure against a contract orientated baseline



#### **Limitations of EVMS**

- Provides problem-indicators only
- Will not make management decisions
- Will not implement corrective action
- □ Will not prevent cost growth
- Compatible only with realistic contract target cost
- □ Is NOT a substitute for project management



### **Opportunities for CAM Discussions**

- Initial Compliance Evaluation
- Compliance Review for Cause
- Integrated Baseline Review
- Estimate at Completion
- System/Program Surveillance



#### **Discussion Philosophy**

- Conversation versus interview
- Questionnaire is a misnomer
  - Intent is to guide you through discussion
  - Provide a logical flow
  - Track concerns, document requests, etc.



### **Discussion Philosophy**

- Do not read the questions from the form
- Do not interrupt the flow to "jot down" answers
- Team approach should ensure complete

coverage



#### **Discussion Process**

- Prepare Prepare Prepare
- "Break the ice"
- Maintain control of the discussion
- "Show me" versus "Tell Me"
- Focus on the objective of the discussion
- Close the discussion



#### **Discussion Don'ts**

- □ DON'T
  - Ask yes/no questions
  - Tie yourself to the list of questions
  - Allow the discussion to stray from the objective
  - Lose control of the discussion
  - Ignore the documentation



#### **Discussion Don'ts**

- □ DON"T
  - Word questions negatively
  - Make derogatory statements
  - Take time during the discussion to write down responses to questions



## **Typical**

- Problems
   Discussion is not in the CAM's workplace
- Information/documentation not available
- Interruptions (phones, people, beepers)
- CAM is not prepared/unfamiliar with documentation
- "Assistants" answer all the questions
- "Tells you" versus "Shows you"
- "I am an Engineer...not a bean counter"
- Argumentative



# Successful Discussion

- Follows logical flow
- Both sides limit attendance
- Government Team prepared
  - Familiar with the system
  - Has a plan for the discussion
  - Not tied to the questionnaire
- Both sides honor the ground rules



# Successful Discussion

- CAM prepared:
  - Documentation available
  - Understands document content
  - Shows support for the answers
  - Communicates!!!!!!!!
- Get copies of need documents
- Agree to areas of concern
- Write-up the discussion findings



#### Want to learn more about EVMS?

Here is a list of websites and documents where more information on EVMS can be found:

- □ OSD Earned Value Management website (www.acq.osd.mil/pm)
  - EVM Industry Guidelines (ANSI/EIA-748-98)
  - EVM Implementation Guide (DLA Handbook 8400.2)
  - C/SSR Joint Guide (DLAI 5000.7)
  - Integrated Baseline Review (IBR)
    - IBR Regulation
    - Training charts Army, Navy, and Air Force
  - Presentations on the training program from the Oct 98 Integrated Program Management Conference
- □ DCMC Homepage (Earned Value) (www.dcmc.hq.dla.mil)
- ☐ Farned Value website (www.nnh.com)



#### More Information on EVM

- Supplier's EVM System Description
- ☐ Supplier's EVM Training for Control Account Managers
- EVM Implementation Guide
  - Review Part I Section 2
  - Review Part I Section 3 (Tutorial)
  - Review Part II Sections 2 and 3
- C/SSR Joint Guide
  - Review Chapter 3 and 4
- □ EVM Industry Guidelines
  - Review Process Discussion (tutorial)
- Personal <u>initiative</u> and <u>motivation</u> most important ingredient